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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Lawrence A. Clevenger

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EXAMINER

KESHAVAN, BELUR V

ART UNIT

PAPER NUMBER

2825

DATE MAILED: 04/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/772,920

Applicant(s)

CLEVENGER ET AL.

Examiner

Belur V Keshavan

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 and 18-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-16 and 18-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Status Of Claims

Claims 1-16 and 18-24 are in the application.

Applicants have amended claims 6, 10 and 15 .

Claim 17, is canceled by applicants.

Claim Objections

Claim10 is objected to because of the following informalities: As claimed in the independent claim 5 and as per features shown in figures 2 and 3, the examiner understands that the slot is filled completely with the metal and not by conducting material as claimed in the dependent claim 10. Appropriate correction to the claim 10 is required without addition of any new material.

Any further rejections of, or indications of the allowability of, claim 10 are based on the claim 10 as it is understood by the examiner.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims1- 4 are rejected under 35 U.S.C. 102(b) as being anticipated by McTeer (U.S. Patent No.5,939,788).

Regarding claims 1, 3 and 4, McTeer discloses, in column 23 and in figure 16, a method of forming an interconnect on a semiconductor substrate (10), comprising: forming relatively narrow first structure at the bottom of the dual damascene structure in a dielectric (14) formed on the semiconductor substrate; forming a relatively wider second structure at the top of the dual damascene structure in the dielectric formed on the semiconductor substrate; forming a liner (2) comprising aluminum and titanium nitride (line 48) in the first and the second structures such that the first structure is substantially filled and the second structure is substantially unfilled; and forming a metallization (3) comprising copper (line 50) over the liner to fill completely the second structure.

Regarding claim 2, McTeer discloses, in column 17 and lines 46-47, wherein the liner is deposited by PVD.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over McTeer in view of Parikh (U.S. Patent No. 6,225,207).

Regarding claim 21 and 22, McTeer anticipates claim 1 as above but lacks forming the relatively narrow first structure not being connected to the relatively wider second structure and forming the wider second structure on the substrate apart from the relatively narrow first structure. However, Parikh teaches, in column 11, lines 31 and figure 5D (554 and 552), forming the relatively narrow first structure (554) not being connected to the relatively wider second structure (552) and forming the wider second structure on the substrate apart from the relatively narrow first structure. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the teachings of McTeer with that of Parikh to form an interconnect on a semiconductor substrate with different design requirements, wider structure to carry large currents and narrow structure for transmitting signals.

Claims 5-15, 23, 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Parikh.

Regarding claims 5, 6, 8, 9, 10, 11-14, Parikh discloses, in columns 14, 15 and 16 and in figures 9A-9F, a method of forming an interconnect on a semiconductor substrate comprising: forming a contact (940) including a slot (924) in a dielectric (916) comprising an oxide and low K polymer dielectric (column 15, lines 37-42) formed on a semiconductor substrate (910); forming troughs (938) into the dielectric structure; depositing a conducting material comprising CVD or PVD tungsten on the dielectric, depositing a metal comprising copper over the conducting material in column 16 and lines 51-57; adjusting the thickness of the metal to fill

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completely the slot and troughs, in column 15 and lines 11-13; removing the conducting material and the metal back to the dielectric (916) and selectively removing the conducting material by CMP or etching, in column 15, and lines 14-17 and in column 16 and lines 20-21.

Regarding claim 7, Parikh discloses, in column 15 and lines 19 –20, contacts (952) comprise contacts formed between first and second metal levels formed on the semiconductor substrate.

Regarding claim 15, Parikh teaches in the abstract that multiple damascene structure which comprises repeating the deposition of the conducting material and the metal on the resulting structure.

Regarding claims 23 and 24, Parikh teaches, in column 11, lines 31 and figure 9F forming the contact (952) not being connected to the trough (956) and forming the trough in the dielectric on the substrate apart from the contact.

Claims 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Parikh

16#20
Regarding claim 16, Parikh discloses, in columns 14, 15 and 16 and in figures 9A-9F, a method of forming an interconnect on a semiconductor substrate comprising: forming troughs (956) between the first and second metal levels, including a slot (950) in a dielectric formed on a semiconductor substrate; forming contacts (952) in the dielectric comprising contacts formed between the first and the second metal levels formed on the semiconductor substrate, thereby to form a dual damascene structure; depositing a conducting material in the dielectric by CVD ; depositing a metal over the conducting material to fill the slot and the troughs; removing the metal either to the conducting material or both the metal and the conducting material

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simultaneously back to the dielectric and selectively removing the conducting material by selective etch

Remarks

In view of the applicants' elucidation of the drawings in response to the Objection to drawings in Office Action of 23 October 2002 is withdrawn.

Applicants' Remarks regarding The Prior Art Rejections of claims 1-16 have been fully considered in view of the Claimed Invention and the Remarks are persuasive. Consequently the Prior Art rejections of claims 1-16 in the Office Action of 23 October 2002 have been withdrawn.

However, in view of the discovery of new references, claims 1-16 and newly added claims 18-24 are rejected.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Belur V Keshavan whose telephone number is 703 306 5985. The examiner can normally be reached on 8-4:30 Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 703 308 1323. The fax phone numbers for the organization where this application or proceeding is assigned are 703- 872-9318 for regular communications and 703-872-9319 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

BVK. *BVK*
April 7, 2003.

Belur V. Keshavan
Examiner. Art Unit 2825



MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
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